Dialogic®

Dialogic® DSI SPCI Network Interface Boards

Programmer's Manual

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Contents

Tables

Figures

Revision History

Issue	Date	Description
7	04-Apr-12	Re-structured manual. Configuration and installation details moved to DSI Software Environment Programmer's Manual.
6	12-Feb-10	Updated to reflect changed support for Windows®. SWITCH_XCON command documented.
5	20-Mar-09	Clarification to ISUP-S and TUP-S protocol dimensioning.
4	05-Mar-09	Removed CPM8 specific content as product is now EOL. Updated to Dialogic® branding. Refreshed operating system support and documented new "bundled" license button set and corresponding run modes.
3	23-May-05	Remove INAP_API module. Change name of package in Solaris DPK to <dpksol32.Z / dpksol64.Z >. Add geographic addressing, gctload as a service, watchdog timer, Linux driver source code release. Added board Option Switch / Link settings, General Module Identification Message and Read Board Info Request Message and Set on-board LED's Message. Add capacity section and support for Windows® XP.
2	06-Jan-03	Branding changed to Intel® NetStructure™. Septel PCI now SPCI4 / SPCI2S and Septel cP now CPM8. References to NUP protocol removed. INAP_API.LIB added.
1	30-Jul-01	Sections detailing support for Windows® 2000, Linux and Solaris added. Additional messages to read LIU state, indicate clock events and s7_mgt completion status.

1 Introduction

The range of Dialogic® DSI SPCI Network Interface Boards includes specialized T1/E1 SS7 signaling boards for use in PCI host computer systems. All boards offer a common interface to the application allowing applications to be easily ported between hardware architectures. This Programmer's Manual relates to the low density Dialogic® DSI SPCI4 Network Interface Boards and Dialogic® DSI SPCI2S Network Interface Boards. Each low density board contains an embedded signaling processor capable of handling up to 4 SS7 signaling links and runs software which is downloaded onto the board at run time.

The boards provide a suitable hardware platform for running the Dialogic® DSI protocol for realizing Signaling System Number 7 signaling nodes. The boards can be used under any of the following operating systems: Windows® XP, Windows® Vista, Windows Server® 2008, Windows Server® 2008 R2 and Windows® 7, Linux and Solaris. This document is the Dialogic® DSI SPCI Network Interface Boards Programmer's Manual and it is targeted at system developers who choose to integrate the boards in a host computer and to develop applications that make use of the underlying SS7 protocol stack. The Programmer's Manual includes information on software installation, system configuration, protocol configuration, and operation of the board and SS7 software stack.

The Programmer's Manual should be used in conjunction with the appropriate Installation Guide and Regulatory Notice for the board, the *Dialogic® Distributed Signaling Interface Components – Software Environment Programmer's Manual* and the Programmer's Manuals for the individual protocol modules as detailed in section 1.1.

High Density board ranges SS7HD and SS7MD are not covered by this manual, and users should refer instead to the relevant documentation package.

1.1 Related Information

Refer to the following for related information:

- *Dialogic® DSI SPCI Network Interface Boards Installation Guide*
- *Dialogic® DSI SPCI Regulatory Notices*
- *Dialogic® Distributed Signaling Interface Components – Software Environment Programmer's Manual*
- *Dialogic® SS7 Protocols MTP2 Programmer's Manual*
- *Dialogic® SS7 Protocols MTP3 Programmer's Manual*
- *Dialogic® SS7 Protocols ISUP Programmer's Manual*
- *Dialogic® SS7 Protocols TUP Programmer's Manual*
- *Dialogic® DSI Protocol Stacks - Host Licensing User Guide*
- *Dialogic® DSI SS7HD Network Interface Boards Programmer's Manual*
- *Dialogic® DSI Signaling Servers Manual*
- *Dialogic® DSI Protocol Stacks SNMP User Manual*

Current software and documentation supporting Dialogic® DSI products is available at http://www.dialogic.com/support/helpweb/signaling

Product data sheets are available at http://www.dialogic.com/support/helpweb/signaling

For more information on Dialogic® DSI SS7 products and solutions, visit http://www.dialogic.com/support/helpweb/signaling

2 Specification

This section provides information about:

- Product Identification
- Dialogic® DSI SPCI Network Interface Board
- License Buttons
- SNMP Support
- Regulatory and Geographic Considerations

2.1 Product Identification

The product designations are as follows:

- Dialogic® DSI SPCI4 Network Interface Boards – Four T1/E1 interfaces
- Dialogic® DSI SPCI2S Network Interface Boards – Two T1/E1 interfaces and two serial interfaces

Throughout this manual the term "SPCI" is used to refer (individually and/or collectively, depending on context) to either or both such type of boards.

2.2 Dialogic® DSI SPCI Network Interface Board

The DSI SPCI board is a standard height, full length PCI form factor. Features of the DSI SPCI board are described in the following topics:

- Capability
- Host Interface
- Physical Interfaces
- Protocol Resource Support
- Visual Indicators
- Power Requirements
- Environmental Specification
- Safety, EMC and Telecommunications Specifications
- Reliability

2.2.1 Capability

Table 1: Dialogic® DSI SPCI Network Interface Board Capability

Number of:	SPCI4	SPCI2S
T1/E1 links	4	2
V.11 / V.35 synchronous serial interfaces	0	2
H.100 Computer Telephony bus (CT bus)	1	1
SS7 links	4	4

2.2.2 Host Interface

The DSI SPCI board is a 32-bit PCI board, but can also be installed in 64-bit PCI slots. The board is keyed as universal and can be installed in either 5 V or 3.3 V signaling environment slots.

2.2.3 Physical Interfaces

The DSI SPCI board supports the following physical interfaces:

- DSI SPCI4 - Four T1/E1 digital trunk interfaces. See Section 2.3.1, "Run Modes" below for more detail.
- DSI SPCI2S – Two T1/E1 digital trunk interfaces.

2.2.3.1 T1/E1 Digital Trunk Interface Properties

The properties of the T1/E1 digital trunk interfaces are described as follows:

- **Standard**

—Each interface is software configurable as either T1 or E1

- **Pulse mask**

— T1: AT&T TR62411

— E1: ITU-T G.703

- **Data rate**

— T1: 1544 kbits/s ± 50 ppm

— E1: 2048 kbits/s ± 50 ppm

- **Frame format**

— T1: D4 and ESF

— E1: E1 and E1-CRC4

- **Line codes**

— T1: B8ZS and AMI

— E1: HDB3 and AMI

- **Connector type**

— RJ-48C

2.2.3.2 SS7 Serial Interface Ports (DSI SPCI2S)

- **Connector**

— 26 pin High density D-type female shared between both ports

- **Electrical**

— V.11 (V.35 compatible)

- **Signals**

— Tx Clock, Rx Clock, Tx Data, Rx Data

- **Data Rate**

— 48kbit/s, 56 kbit/s, 64 kbit/s or external.

2.2.3.3 H.100 CT Bus

An H.100 CT Bus interface is provided to allow connection to other H.100 compatible boards. The H.100 CT Bus supports 4096 channels (or timeslots) and the associated clock and framing signals. This board is capable of generating the CT Bus clocks, or can act as a slave. CT Bus channels may be used individually, or grouped to provide a higher bandwidth data path.

The signals are carried between boards in a host computer using an H.100 CT Bus ribbon cable.

- **Bus type**

— H.100 CT Bus

- **Clock rate**

— 8192 kHz

- **Connector**

— Edge connector

- **Clocking**

— Master or Slave

2.2.4 Protocol Resource Support

When used in a signaling node, the DSI SPCI board supports the Message Transfer Part (MTP) running on the board and optionally other protocols including MTP3, ISUP and TUP. Board based protocols are enabled by a license button.

MTP3, ISUP, TUP, SCCP, TCAP, MAP, INAP and IS41 can also be run on the host. The protocols are enabled by software licenses. See Section 2.3, “License Buttons” on page 12.

2.2.5 Visual Indicators

The DSI SPCI board includes the following visual indicators:

User LED’s : Three general purpose red LEDs, labeled A, B and C, are available to the user application.

2.2.6 Power Requirements

Power requirements are described as follows:

• +5 VDC ± 5% power

2.0 A max., 1.5 A typ.

• Power dissipation

10.5 W max.

2.2.7 Physical Specification

- **Form factor**

standard height, full length PCI board

- **Dimensions**

Board

Length	341 mm (13.425 inches)
Height	106 mm (4.17 inches)

Packaged

Length	406.4 mm (16 inches)
Width	219 mm (8.625 inches)
Height	44.5 mm (1.75 inches)

- **Weight**

Board	
DSI SPCI2S	211 g
DSI SPCI4	180 g
Packaged board	
DSI SPCI2S	553 g
DSI SPCI4	522 g

2.2.8 Environmental Specification

Environmental specification is described as follows:

• Operating temperature range

+0°C to +55°C

• Storage temperature range

-40°C to +70°C

• Humidity

0 to 95% non-condensing

• Altitude

0 to 3,500 ft

2.2.9 Safety, EMC and Telecommunications Specifications

Safety, EMC and telecommunications specification information is provided by the following:

• Dialogic® DSI SPCI4 Network Interface Boards and Dialogic® DSI SPCI2S Network Interface Boards Regulatory Notices

Supplied with each product and provides a list of the specifications to which the DSI SPCI board conforms.

• International Declaration of Conformity

See http://www.dialogic.com/declarations

• Country-Specific Approvals

See the Global Product Approvals list at http://www.dialogic.com/declarations Alternatively, contact your Dialogic technical sales representative for more information.

2.2.10 Reliability

Product reliability is described by:

• MTBF Predication

204,000 hours per Bellcore Method @40ºC

• Warranty

See Dialogic® Telecom Products Warranty Information at http://www.dialogic.com/warranties

2.3 License Buttons

The ss7.dc3 code file supports different protocol module combinations that are enabled by fitting the correct license button to the board. Each license button is marked with a two letter code that is used for identification.

2.3.1 Run Modes

The **run_mode** parameter in either the SS7_BOARD command or the Board Reset Request message determines the protocol modules that are started by the code file at run time. The following table shows the relationship between the license buttons and the supported run modes.

Table 2: Relationship between License Button Codes, Run Modes and Protocol Modules

Button Code	Item Market Name	Description	Maximum Number of SS7 Links	Run Modes supported								
				MTP2	MTP3	ISUP-S	ISUP	ISUP-L	TUP-S	TUP	TUP-L	MON
MM	SS7SBPCIMONQ	Monitoring	4									√
M3	SS7SBPCIMTPQ	MTP	4	√	√							√
T1	SS7SBPCIISTUPSQ	ISUP, TUP (Small)	2	√	√	√			√			√
T2	SS7SBPCIISTUPQ	ISUP, TUP (Regular)	4	√	√		√			√		√
T4	SS7SBPCIISTUPLQ	ISUP, TUP (Large)	4	√	√			√			√	√

2.3.2 Capacity

The figures in the table below indicate the capacity for modules running on the DSI SPCI Boards.

Table 3: Protocol Dimensioning

Run Mode	Capacity			
	Maximum Number of Link Sets	Maximum Number of Routes	Maximum Number of Circuit Groups	Maximum Numbers of Circuits
MTP3	4	64		
ISUP-S	2	64	44	1024
TUP-S	2	64	44	1024
ISUP	4	64	64	2048
TUP	4	64	64	2048
ISUP-L	4	64	128	4096
TUP-L	4	64	128	4096

2.4 SNMP Support

The Dialogic® Distributed Structured Management Information (DSMI) Simple Network Management Protocol (SNMP) Agent provides SNMP monitoring functionality for the Dialogic® DSI SS7 Development Package.

Dialogic® DSMI SNMP software supports SNMP V1, V2 and V3 reporting the state and events for Dialogic® DSI SPCI Boards and Dialogic® DSI Protocol Stacks through use of SNMP traps as well as queries from a SNMP manager.

The Dialogic® DSMI MIBs are distributed within the Dialogic® DSI SS7 Development Package in the /opt/DSI sub-directory as a compressed ZIP file: dsi-mibs.zip.

For details of the DSMI SNMP MIBs supported, events, SNMP traps and configuration refer to the *Dialogic® DSI Protocol Stacks SNMP User Manual*.

2.5 Regulatory and Geographic Considerations

Certain functions of the Dialogic® DSI SPCI Network Interface Boards, although implemented in hardware, have selectable options that are configured by the software. A user or integrator must consider the requirements of the application when choosing these settings, but must also consider any local regulatory requirements for the intended deployment location to provide a compliant overall system. As an aid to this process, the table below details some of the areas where the correct selection of configuration options may be required.

Configuration Area		Configuration Options
T1/E1 Ports	Interface type	liu_type parameter in LIU_CONFIG command
	Pulse shape	liu_type parameter in LIU_CONFIG command
	Line code	line_code parameter in LIU_CONFIG command
	Frame format	frame_format parameter in LIU_CONFIG command
	CRC/E-bit operation	CRC_mode parameter in LIU_CONFIG command
	Clock priorities	flags parameter in SS7_BOARD command and options parameter in LIU_CONFIG command
CT Bus	Master/Slave configuration	flags parameter in SS7_BOARD command
	Bus termination	flags parameter in SS7_BOARD command
Links	Link termination or monitoring mode	MTP_LINK or MONITOR_LINK commands

Note: For details on these configuration commands please refer to *Dialogic® Distributed Signaling Interface Components – Software Environment Programmer's Manual*.

3 SPCI Board Configuration and Operation

Before attempting software configuration, you should gain an understanding of the flexibility of the protocol stack, the run-time options that exist and the mechanisms that are used to select specific features. This section gives an overview of these options. You should also read the *Dialogic® Distributed Signaling Interface Components – Software Environment Programmer's Manual* that describes the basic principles of modules and message passing.

This section provides information about:

- System configuration using SPCI Boards
- Board Code File
- Using the CT bus

3.1 System configuration using SPCI Boards

Some SS7 protocol modules can be run on either the host machine or on DSI SPCI boards. The following table shows the possible options for each protocol:

Protocol	Option
ISUP, TUP	Host or board
MTP3	Host or board
MTP2	Board only.

Host protocol software is available for Linux, Solaris SPARC, Solaris x86 and Windows® operating systems. For more information or to purchase, contact an authorized distributor or your account manager.

The Dialogic® DSI SPCI Network Interface Board may be configured for most applications using the s7_mgt utility. The s7_mgt utility is the primary tool for configuring a DSI software stack. It is a single-shot configuration utility that takes configuration commands from a text file (config.txt).

Details on how to configure a system using s7_mgt are provided in the *Dialogic® Distributed Signaling Interface Components – Software Environment Programmer's Manual*.

As an alternative to using s7_mgt, users can build their own configuration utilities using messaged-based configuration. In this case users should refer to the definitions of individual messages in Section 4, Message Reference on page 20.

The Code File contains the operating firmware for the board which is downloaded to the board at run-time by the ssds binary. The code file should be specified in the SS7BOARD command in the config.txt file.

3.2 Board Code File

The DSI Network Interface Boards Code Files contain the operating software for the DSI Network Interface Boards. The appropriate code file must be downloaded by the host, to the board, at run-time.

The following code files available for the DSI SPCI board:

- The ss7.dc3 code file which should be used for DSI SPCI boards running SS7 protocols.
- The mon.dc3 code file which should be used for DSI SPCI boards running monitoring applications.

Note: The *.dc3 code file are distributed as part of the Dialogic® DSI Development Package.

The code file requires a license button to be fitted to the board which enables the software to run on the board, details are given in Section 2.3 License Buttons on page 12.

3.3 Using the CT bus

The DSI SPCI2S and DSI SPCI4 boards support two or four T1/E1 Line Interface Units and a CT bus interface (H.100) respectively. The on-board signaling processor handles the SS7 signaling timeslots whilst the remaining circuits (voice or data bearer circuits) are passed to the CT bus for distribution to other boards.

All communication between the application and the board is message-based. Initial configuration is usually handled by the configuration utility **s7_mgt**, which takes commands from the text file (**config.txt**) and generates all the necessary configuration messages for the board. Subsequent operation is entirely message driven, messages being passed in both directions between the board and the application.

One of the roles of the application is to control the dynamic switching between the CT bus and the T1/E1 line interfaces. This section provides details of how to interface with the CT bus, including the initial (static) configuration and the subsequent (dynamic) switching.

The operation of the CT bus switching interface is described in terms of the SCbus switching model using the messages **MVD_SC_DRIVE_LIU**, **MVD_MSG_SC_LISTEN** and **MVD_MSG_SC_FIXDATA** and config.txt commands **LIU_SC_DRIVE** and **SCBUS_LISTEN**.

3.3.1 Switching Model

The basic switching model assumes that at system initialization all incoming T1/E1 timeslots and all resource board output timeslots are connected up to channels on the CT bus and that these connections are never changed. This has the advantage that once the on-board CT bus drivers have been set up they are never changed so the chances of inadvertently causing CT bus conflict is minimized. It also means that the user can predict the exact CT bus channels where any input timeslot can be located and this in turn can assist with fault diagnosis and general system test.

It is also possible to generate fixed patterns on any T1/E1 output timeslots to provide the correct idle pattern for presentation to the network on all circuits where there is no active call.

Having completed the system initialization, all drives to the CT bus are set up. Then, on a dynamic (call by call) basis, the connectivity must be modified when a new call arrives and when it finishes.

When a new call arrives, the application, in general, needs to initiate two listen commands. One command causes the resource to listen to the appropriate CT bus channel to hear the incoming voice path and the other causes the T1/E1 interface to listen to the output from the resource board to generate the outgoing voice path.

When a call clears, the application needs to initiate generation of the fixed idle pattern towards the network operation (and may wish to connect an idle pattern to the resource board).

3.3.2 Static Initialization

Static initialization is handled by the s7_mgt utility. For each T1/E1 line interface unit, user must include an **LIU_SC_DRIVE** command in the config.txt file. The syntax for this command is detailed in *Dialogic® Distributed Signaling Interface Components – Software Environment Programmer's Manual*.

The **LIU_SC_DRIVE** command has several parameters. **board_id** and **liu_id** together uniquely identify the affected line interface unit. **sc_channel** is the channel number of the first channel on the CT bus that is to be used for timeslots from the specified LIU. **ts_mask** is a mask identifying which timeslots on the T1/E1 interface are carrying voice circuits (as opposed to signaling) and therefore need to be connected to the CT bus. The least significant bit of **ts_mask** must always be zero when driving from an T1/E1 interface.

As an example, consider a two board system where the first board has 4 E1 ports and the second board has 4 T1 ports. We allow the first 512 CT bus channels to be used by other boards in the system and therefore start at sc_channel 512.

```
LIU_SC_DRIVE 0 0 512 0xfffefffe  * 30 E1 voice ccts on ts 1..15 & 17..31
LIU_SC_DRIVE 0 1 542 0xfffefffe  * 30 E1 voice ccts on ts 1..15 & 17..31
LIU_SC_DRIVE 0 2 572 0xfffefffe  * 30 E1 voice ccts on ts 1..15 & 17..31
LIU_SC_DRIVE 0 3 602 0xfffefffe  * 30 E1 voice ccts on ts 1..15 & 17..31
LIU_SC_DRIVE 1 0 632 0x00fffffe  * 23 T1 voice ccts on timeslots 1..23
LIU_SC_DRIVE 1 1 655 0x00fffffe  * 23 T1 voice ccts on timeslots 1..23
LIU_SC_DRIVE 1 2 678 0x00fffffe  * 23 T1 voice ccts on timeslots 1..23
LIU_SC_DRIVE 1 3 701 0x00fffffe  * 23 T1 voice ccts on timeslots 1..23
```

3.3.3 Dynamic Operation

The application controls dynamic changes to CT bus switching by sending the **MVD_MSG_SC_LISTEN** message to the board. This message is documented in Section 4.3.6 MVD_MSG_SC_LISTEN - CT bus Listen Request. It contains the **liu_id**, the **timeslot** number on the T1/E1 interface and the CT bus channel number (**sc_channel**) to which the timeslot listens. The message is directed to the correct board by calling the **GCT_set_instance** function prior to calling **GCT_send**.

When a new call arrives, the application needs to instigate two listen commands (although they do not necessarily both apply to the SS7 board). One connects the voice circuit in the forward direction and the other connects it in the backward direction.

When a call terminates, the application must issue a fixed data message to ensure the network port sees the voice idle pattern.

3.3.4 Example Code - Building and Sending SC_LISTEN

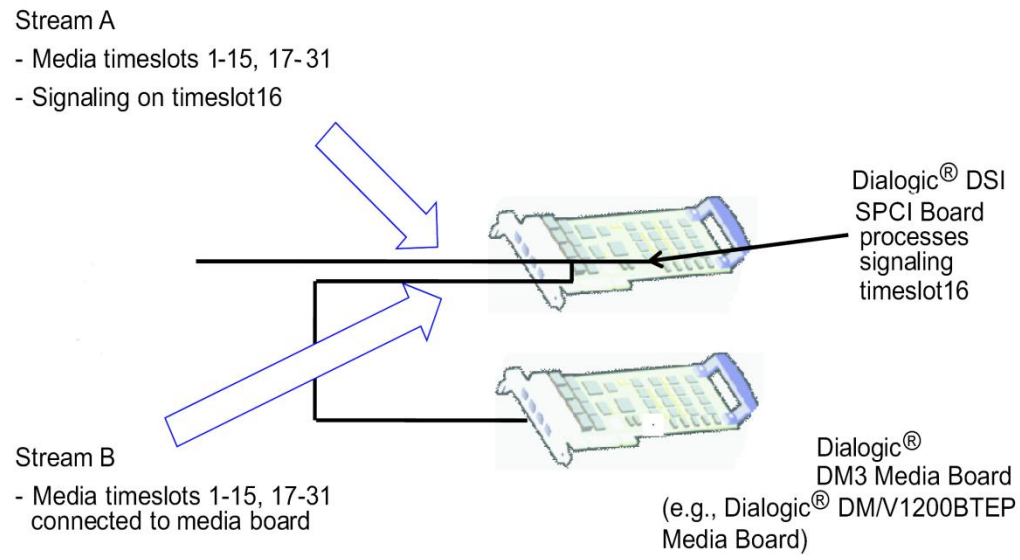
```
/*
 * Example function for building and sending an MVD_MSG_SC_LISTEN
 * message to a SPCI2S or SPCI4 signalling board.
 *
 * The only change that the user needs to make is to fill in the
 * OUR_MOD_ID definition below so that is equal to the module_id
 * of the application module.
 */
```

```
#define OUR_MOD_ID   (0xef)

#include "system.h"             /* Definitions of u8, u16 etc */
#include "msg.h"                /* Definitions of HDR, MSG etc */
#include "libc.h"               /* Used only for memset prototype */
#include "sysgct.h"             /* Prototypes for GCT_xxx */
#include "pack.h"               /* Prototypes for rpackbytes */
#include "ss7_inc.h"            /* Message & module definitions */

/*
 * Macro to generate the value for use in the rsp_req field of the
 * message header in order to request a confirmation message:
 */
#define RESPONSE(module)      (((unsigned short) 1) << ((module) & 0x0f))

/*
 * Function to drive an SCbus / CT bus timeslot
 * onto a timeslot on a PCM port:
 */
int listen_to_scbus(board_id, liu_id, timeslot, sc_channel)
  int board_id;         /* board_id (0, 1, 2 ...) */
  int liu_id;           /* PCM port id (*/
  int timeslot;         /* Timeslot on the PCM port (1 .. 31) */
  int sc_channel;       /* SCbus / CT bus channel number */
{
  MSG   *m;
  u8    *pptr;

  /*
   * Allocate a message (and fill in type, id, rsp_req & len):
   */
  if ((m = getm(MVD_MSG_SC_LISTEN, 0, RESPONSE(OUR_MOD_ID), MVDML_SCLIS)) != 0)
  {
    pptr = get_param(m);
    memset(pptr, 0, m->len);

    /*
     * Enter the parameters in machine independent format:
     */
    rpackbytes(pptr, MVDMO_SCLIS_liu_id, (u32)liu_id, MVDMS_SCLIS_liu_id);
    rpackbytes(pptr, MVDMO_SCLIS_timeslot, (u32)timeslot, MVDMS_SCLIS_timeslot);
    rpackbytes(pptr, MVDMO_SCLIS_sc_channel, (u32)sc_channel,
MVDMS_SCLIS_sc_channel);

    m->hdr.dst = MVD_TASK_ID;
    m->hdr.src = OUR_MOD_ID;

    /*
     * Call GCT_set_instance to route the message to the
     * correct board and GCT_send to send the message.
     * If GCT_send returns non-zero release the message.
     */
    GCT_set_instance(board_id, (HDR *)m);
    if (GCT_send(m->hdr.dst, (HDR *)m) != 0)
      relm((HDR *)m);
  }
  return(0);
}
```

3.3.5 Interconnecting LIUs using STREAM_XCON

Interconnection of two Line Interface Units (LIUs) on the Dialogic® DSI SPCI Interface Network Board is also supported through the STREAM_XCON command which controls the cross connect switch on the DSI SPCI Board signaling, enabling the cross connection of timeslots between any two LIUs within the DSI SPCI Board. This command simplifies the cross connection enabling a group of timeslots on one LIU to be directly mapped to the same numbered timeslots on a second LIU on the same DSI SPCI Board using a single command. A typical usage of the STREAM_XCON command is shown in Figure 2 which implements Drop and Insert functionality.

Figure 1 Drop and Insert



STREAM_XCON mode 3 “Duplex cross-connect the input and output timeslot”

Timeslot mask = 0xfffefffe

4 Message Reference

4.1 Overview

This section describes the individual messages that may be sent to and received from the Dialogic® DSI SPCI Network Interface Board. Some messages are sent by the user's application software whilst others are sent by utility programs such as the s7_mgt protocol configuration utility.

Prior to sending any message to the board, the application should call the **GCT_set_instance( )** library function to select which board the message will be sent to. After receiving a message from the board, the application should call the **GCT_get_instance( )** library function to determine which board the message came from. These library functions are described in the *Software Environment Programmer's Manual*.

The various messages used are grouped in the following categories:

- General Configuration Messages
- Hardware Control Messages
- Event Indication Messages
- Status Request Messages

4.1.1 Message Type Summary

The following table lists, by message type, the messages described in this manual:

Table 4: Message Summary

Message Type	Mnemonic	Description
0x0008	MGT_MSG_EVENT_IND	Error Indication
0x0201	MGT_MSG_SS7_STATE	MTP2 Level 2 State Indication
0x0202	MGT_MSG_SS7_EVENT	MTP2 Q.752 Event Indication
0x0301	MGT_MSG_MTP_EVENT	MTP3 Q.752 Event Indication
0x06a0	SSD_MSG_STATE_IND	Board Status Indication
0x0e01	MVD_MSG_LIU_STATUS	LIU Status Indication
0x0e23	MVD_MSG_CLK_IND	Clock Event Indication
0x0f09	API_MSG_CNF_IND	s7_mgt Completion Status Indication
0x1e37		Confirmation of LIU_MSG_R_CONFIG
0x1e38		Confirmation of LIU_MSG_R_CONTROL
0x1e39		Confirmation of LIU_MSG_R_STATE
0x3312		Confirmation of MTP_MSG_CNF_ROUTE
0x3680		Confirmation of SSD_MSG_RESET
0x3681		Confirmation of SSD_MSG_RST_BOARD
0x3e00		Confirmation of MVD_MSG_RESETSWX

Message Type	Mnemonic	Description
0x3e15		Confirmation of MVD_MSG_SC_FIXDATA
0x3e17		Confirmation of MVD_MSG_SC_LISTEN
0x3e18		Confirmation of MVD_MSG_SC_DRIVE_LIU
0x3e19		Confirmation of MVD_MSG_SC_MULTI_CONNECT
0x3e1f		Confirmation of MVD_MSG_SC_CONNECT
0x3e20		Confirmation of MVD_MSG_CNFCLOCK
0x3e21		Confirmation of MVD_MSG_CLK_PRI
0x3e34		Confirmation of LIU_MSG_CONFIG
0x3e35		Confirmation of LIU_MSG_CONTROL
0x3f10		Confirmation of MGT_MSG_CONFIG0
0x5e36	LIU_MSG_R_STATS	LIU Read Statistics Request
0x5e37	LIU_MSG_R_CONFIG	LIU Read Configuration Request
0x5e38	LIU_MSG_R_CONTROL	LIU Read Configuration Request
0x5e39	LIU_MSG_R_STATE	LIU State Request
0x6f0d	MGT_MSG_R_BRDINFO	Read Board Info Request Message
0x7680	SSD_MSG_RESET	SSD Reset Request
0x7681	SSD_MSG_RST_BOARD	Board Reset Request
0x7e00	MVD_MSG_RESETSWX	Reset Switch Request
0x7e15	MVD_MSG_SC_FIXDATA	Fixed Data Request
0x7e17	MVD_MSG_SC_LISTEN	SCbus Listen Request
0x7e18	MVD_MSG_SC_DRIVE_LIU	SCbus Initialization Request
0x7e19	MVD_MSG_SC_MULTI_CONNECT	Multiple Connect Request
0x7e1f	MVD_MSG_SC_CONNECT	SCbus Connect Request
0x7e20	MVD_MSG_CNFCLOCK	Configure Clock Request
0x7e21	MVD_MSG_CLOCK_PRI	Configure Clock Priority Request
0x7e34	LIU_MSG_CONFIG	LIU Configuration Request
0x7e35	LIU_MSG_CONTROL	LIU Control Request
0x7f10	MGT_MSG_CONFIG0	Board Configuration Request

4.1.2 Board-specific Module IDs

Table 5 lists the software modules IDs (by mnemonic and value) used on the DSI SPCI Board.

Table 5. DSI SPCI Board Software Module IDs

Mnemonic	Value	Description
MGMT_TASK_ID	0x8e	SPCI Board Management Module
MVD_TASK_ID	0x10	SPCI LIU and Switch Management Module
SS7_TASK_ID	0x71	MTP2 Module
MTP_TASK_ID ‡	0x22	Onboard MTP3 Protocol module
ISUP_TASK_ID ‡	0x23	Onboard ISUP Protocol module
TUP_TASK_ID ‡	0x4a	Onboard TUP Protocol module

NOTES:

1. ‡ The availability of these Module IDs depends on the selected board run_mode. See Section 2.3.1, Run Modes on page 12 for more information.

4.1.3 Message Status Summary

The following table shows the valid responses when a response request (rsp_req) is requested in a message.

Table 6. Message Status Responses

Value	Mnemonic	Description
0x00	SDE_MSG_OK	Success
0x01	SDE_BAD_ID	Inappropriate or invalid id in request message
0x02	SDE_BAD_STATE	Message received in wrong state
0x03	SDE_BAD_SIG	Bad signal received
0x04	SDE_UNEX_SIG	Unexpected signal received
0x05	SDE_BAD_MSG	Unsupported message received
0x06	SDE_BAD_PARAM	Invalid parameters contained in message
0x07	SDE_NO_RESOURCES	Insufficient internal message resources
0x08	SDE_INVALID_NC	Invalid Network Context
0x09	SDE_INVALID_VERSION	Message version is invalid
0x0e	SDE_LICENCE_ERR	Failure due to a licensing restriction
0x0f	SDE_INTERNAL_ERR	Failure due to an internal error

4.2 General Configuration Messages

General configuration messages are typically issued by the s7_mgt protocol configuration utility, in which case they need not, and should not, be generated by any user application software.

If the user elects not to use the s7_mgt protocol configuration utility, it is necessary for the application to build and send messages that:

- configure the ssd module
- reset each board
- configure each board
- optionally configure additional routes

The messages in the general configuration category include:

- SSD_MSG_RESET - SSD Reset Request
- SSD_MSG_RST_BOARD - Board Reset Request
- MGT_MSG_CONFIG0 - Board Configuration Request

4.2.1 SSD_MSG_RESET - SSD Reset Request

Synopsis

Message sent to SSD once at initialization to set up run-time options.

Note: When using s7_mgt, this message is generated by s7_mgt and must not be generated by the user.

Format

MESSAGE HEADER	
Field Name	**Meaning**
type	SSD_MSG_RESET (0x7680)
id	0
src	Sending module's module_id
dst	SSD_TASK_ID (0x20)
rsp_req	used to request a confirmation
hclass	0
status	Status Response (if confirmation requested)
err_info	0
len	24

PARAMETER AREA		
Offset	**Size**	**Name**
0	1	module_id - must be set to SSD_TASK_ID
1	2	reserved – set to zero
3	1	mgmt_id
4	18	reserved – set to zero
22	2	num_boards

Description

This message is used during initialization by the application to reset the ssd module and set up its run-time parameters.

Parameters

mgmt_id

The module_id of the management module, to which ssd sends board status indications.

num_boards

The maximum number of boards that ssd is required to manage. This must not exceed 16.

Status Response

The confirmation message (if requested) indicates success by **status** of zero.

On error, the following value can be found in the status message confirmation.

Value	Mnemonic	Description
2	SSD_BAD_PARAM	The SSD Reset Request message was incorrectly formatted.

4.2.2 SSD_MSG_RST_BOARD - Board Reset Request

Synopsis

Message sent to SSD to cause a single board to be reset and a code file downloaded.

Note: When using s7_mgt, this message is generated by s7_mgt and must not be generated by the user.

Format

MESSAGE HEADER	
Field Name	**Meaning**
type	SSD_MSG_RST_BOARD (0x7681)
id	board_id
src	Sending module's module_id
dst	SSD_TASK_ID (0x20)
rsp_req	used to request a confirmation
hclass	0
status	Status Response (if confirmation requested)
err_info	0
len	26

PARAMETER AREA		
Offset	**Size**	**Name**
0	2	board_type
2	4	phy_id
6	18	code_file
24	2	run_mode

Description

This message is used during initialization (or re-configuration) by the application to reset a board and download the code file that contains the operating software for the board.

The download operation is supervised by the device driver that reads the binary format code file and transfers it to the board.

The confirmation message (if requested) indicates success by **status** of zero. This implies that the reset operation has commenced but does not imply completion. The application must then wait until a **Board Status Indication** is received. This indicates either successful completion of the reset and download operation or failure during the procedure.

Parameters

board_type

The type of board to be reset. This must be set to 2 for DSI SPCI Boards.

phy_id

The physical ID for the DSI SPCI Board. This field must be set to the same value as the board_id. (i.e., 0 … one less than the number of boards supported).

code_file

Null terminated string giving the filename of the code file to be downloaded to the board.

run_mode

Number taken from the following table to indicate which protocols are to be run.

Note: It is only possible to activate protocols that have been licensed to run on the board by use of a suitable license button.

Run Mode Value	Run Mode Mnemonic	Protocols selected to run on the board
1	DTI	Digital Trunk Interface only, no protocol software. This mode does NOT require the use of a software license button.
2	MTP2	MTP2 protocol only.
3	MTP	MTP3 plus MTP2 protocols.
25	ISUP-S	ISUP, small version, plus all MTP.
4	ISUP	ISUP, regular version, plus all MTP.
5	ISUP-L	ISUP, large version, plus all MTP.
26	TUP-S	TUP, small version, plus all MTP.
6	TUP	TUP, regular version, plus all MTP.
7	TUP-L	TUP, large version, plus all MTP.

See section 2.3.2 Capacity for details of the capacity for modules running on the DSI SPCI Boards.

Status Response

The confirmation message (if requested) indicates success by **status** of zero.

No status values indicating errors are defined.

4.2.3 MGT_MSG_CONFIG0 - Board Configuration Request

Synopsis

Message sent to a board immediately after starting the code running to provide protocol configuration parameters.

Note: When using s7_mgt, this message is generated by s7_mgt and must not be generated by the user.

Format

MESSAGE HEADER	
Field Name	**Meaning**
type	MGT_MSG_CONFIG0 (0x7F10)
id	0
src	Sending module's module_id
dst	MGMT_TASK_ID (0x8e)
rsp_req	used to request a confirmation
hclass	0
status	Status Response (if confirmation requested)
err_info	0
len	68

PARAMETER AREA		
Offset	**Size**	**Name**
0	2	config_type (Must be set to 2)
2	2	flags
4	2	l1_flags
6	2	l2_flags
8	2	max_sif_len
10	2	l3_flags
12	4	pc
16	2	ssf
18	2	up_enable
20	2	link0_flags
22	2	link0_slc
24	4	link0_adj_pc
28	2	link0_stream
30	2	link0_timeslot
32	2	link1_flags
34	2	link1_slc
36	4	link1_adj_pc
40	2	link1_stream
42	2	link1_timeslot
44	2	link2_flags
46	2	link2_slc
48	4	link2_adj_pc
52	2	link2_stream
54	2	link2_timeslot
56	2	link3_flags
58	2	link3_slc
60	4	link3_adj_pc
64	2	link3_stream
66	2	link3_timeslot

Description

This message must be the first message sent to the DSI SPCI Board once the SS7 software is running. It is used to configure all modules on the board for operation. The message contains signaling point codes for this signaling point and the adjacent signaling point(s), flags to permit various level 1, level 2, and level 3 run-time options to be selected and the physical link parameters.

Once the DSI SPCI Board has been configured, you must reset it before configuring it again.

The confirmation message (if requested) indicates success by **status** of zero. To ensure configuration is complete before subsequent messages are issued to the board, the user should always request a confirmation message and check the status for success.

If the board is not licensed to run the requested software configuration, status value of 0xfe is returned.

Parameters

flags - Global flags

Bit 0 is set to 1 to indicate that the user does not wish to use signaling software. This allows operation of the board without a software license button providing the board is used only for T1/E1 interface and switching purposes. If signaling software is required, then this bit must be set to zero.

Bit 9 is set to 1 to disable automatic MTP route configuration, in which case the user must send individual MTP Route Configuration messages for each destination. When set to zero, the board automatically configures an MTP route to each adjacent signaling point using the link set directly connected to the signaling point.

Bit 12 is set to 1 to cause all signaling links to be automatically activated. Usually, this bit is set to zero and the user sends individual MTP Link Activation requests to activate each link.

Bit 15 is set to 1 for diagnostic purposes to cause the results of internal board configuration to be passed to the host. When set, all confirmation messages generated internally on the board during the configuration sequence are sent to the module_id 0xdf on the host.

All other bits are reserved for future use and must be set to zero.

l1_flags - level 1 flags

Bit 0 controls the reference source used for on-board clocks when acting as CT bus Primary Master. If set to 1, the clock is recovered from one of the line interfaces. If set to zero, the on-board clock oscillator is used.

Bit 6 and **7** together select the initial CT bus clocking mode as shown in the following table. The clocking mode can be modified subsequently and dynamically using the MVD_MSG_CNFCLOCK message.

Bit 7	Bit 6	CT bus clocking mode
0	0	**The CT bus interface is disabled -** The board is electrically isolated from the other boards using the CT bus. The CT bus connection commands may still be used, but the connections made are only visible to this board. The on-board clocks are synchronized to the source selected by bit 0 of this flags parameter.

0	1	**Primary Master, A Channel** - The board drives CT bus clock set A using the clock source selected by bit 0 of this flags parameter.
1	0	**Secondary Master, B Channel** - The board is configured to drive clock set B in Secondary Master mode. The on-board clocks are synchronized to the CT bus clock set A. It will automatically switch to become Primary Master if the board driving clock set A fails.
1	1	**Slave, initially A Channel** – The board uses the CT bus clocks, which must be generated by another board on the CT bus. Initially the board recovers from clock set A, though will switch over automatically to recover from clock set B if set A fails.

Bit 13 is set to 1 to cause the board to drive the CT_NETREF1 clocks on the CT bus. The highest priority in-sync line interface is used as a clock source. If this bit is set to zero then CT_NETREF1 clock is not driven.

All other bits are reserved and must be set to zero.

l2_flags - level 2 flags

Bit 1 is set to 1 for ANSI operation or zero for ITU-T operation.

Bit 3 is set to 1 for ANSI operation or zero for ITU-T operation.

Bit 5 is set to 1 to cause Link Status Signal Units (LSSU) to have a two octet status field. Usually this bit is set to zero, and LSSUs have a single octet status field.

All other bits are reserved for future use and must be set to zero.

max_sif_len - maximum Signaling Information Field length

The maximum Signaling Information Field length in octets that is permitted over the signaling link. Usually set to 272 although it may be set to 62 for inter-working with switches that do not support 272 octet messages.

l3_flags - level 3 flags

Bit 0 is set to 1 to disable the level 3 discrimination function (allowing the signaling point to receive all messages irrespective of the destination point code contained in the message) or zero to allow the discrimination function to function normally.

Bit 1 is set to 1 to disable sub-service field (SSF) discrimination. If this bit is set to zero, received MSUs whose ssf values do not match the configured ssf value are discarded.

Bit 8 is set to 1 to select ANSI operation or zero for ITU-T operation.

Bit 9 is set to 1 to select ANSI style 24 bit point codes in the MTP routing label or zero to select ITU-T style 14 bit point codes. This bit must be set to 1 if ANSI operation is selected.

Bit 10 is set to 1 for ANSI operation or zero for ITU-T operation.

Bit 11 is set to 1 for ANSI operation or zero for ITU-T operation.

All other bits are reserved for future use and must be set to zero.

Note: For ANSI operation bits 8, 9, 10, and 11 must all be set to 1.

pc - point code

The pure binary representation of this signaling point code. Must be in the range 0 to 16383 for 14 bit point code operation, or 0 to 16777215 for 24 bit point code operation.

ssf - sub-service field

The value used in the sub-service field of all messages generated by level 3. Must be in the range 0 to 15. For ANSI operation, the 2 least significant bits must be set to 1.

up_enable - User Part Enable

A 16 bit mask used to enable or disable reception of messages on a per user part basis. If bit N is set to 1, then messages for user part N are received by the signaling point.

For example, to enable the TUP User Part (Service indicator = 4) set the up_enable field to 0x0010, For ISUP (Service Indicator = 5), set the up_enable field to 0x0020. To use both TUP and ISUP, set up_enable to 0x0030.

link*n*_flags - Per link flags

Bit 0 is set to 1 to force the use of the emergency proving period during link alignment. This bit is usually set to zero and uses the appropriate proving period according to Q.703.

Bit 1 is set to 1 to cause a signaling link test (in accordance with ITU-T Q.707) to be carried out before a link is put into service, or zero if a test is not required. This bit is usually set to 1.

Bit 2 is set to 1 to cause a signaling link test (in accordance with ITU-T Q.707) to be carried out every 30 seconds. This bit is usually set to 1, but is ignored if Bit 1 is set to zero.

Bit 8 is used to select the MTP2 error correction mode. It is set to 1 to select PCR (Preventive Cyclic Retransmission) operation, or zero for the Basic Method of Error Correction.

Bits 10 and 11 are used to select the data rate for the link as detailed below.

Bit 11	Bit 10	Data Rate
0	0	64kbps
1	1	56kbps
0	1	48kbps

Note: When using a serial port, 56 kbps and 48 kbps operation is only supported when the clock is applied externally.

Bit 12 when set MTP2 links are configured individually via SS7_MSG_CONFIG.

Bit 13 is only used when the link has been configured to run over a serial port (i.e., bit 14 is set). If set to 1, an external clock is used (Receive clock). If set to zero, an internal clock (Transmit clock) is used. If the link has not been configured to run over a serial port, this bit must be set to zero.

Bit 14 is set to 1 to use a serial port, rather than a PCM timeslot for this link. In this mode the stream and timeslot parameters for this link are ignored (and must be set to zero). If this bit is set to zero, the link uses the specified stream and timeslot. The serial port used by the signaling processors for each link is fixed, according to the following table:

Link	Serial Port
0	B
1	A
2	Cannot be used for a serial port.
3	Cannot be used for a serial port.

Bit 15 is set to 1 to disable the link, or zero to enable the link.

All other bits are reserved for future use and must be set to zero.

linkn_slc - Signaling link code

The signaling link code for the link, which must be in the range 0 to 15. The signaling link code must be agreed with the administration at the other end of the link and must be unique within a link set. Usually, the first link in a link set is assigned the value 0, the next 1, and so on.

link*n*_adj_pc - Adjacent point code

The point code of the signaling point at the remote end of the link. Must be in the range 0 to 16383 for 14 bit point code operation or 0 to 16777215 for 24 bit point code operation.

Note: All links in a link set must have the same adjacent point code.

linkn_stream - Signaling stream

When linkn_timeslot is set to a non-zero value, the linkn_stream is the logical identity of the T1/E1 line interface (liu_id - in the range 0 to one less than the number of LIUs fitted) containing the signaling link.

Note: For the DSI SPCI2S, stream identifiers for the PCM interfaces are implemented on streams 2 and 3.

linkn_timeslot - Signaling timeslot

The timeslot used for signaling. For an E1 interface, the valid range is 1 ... 31. For a T1 interface, the valid range is 1 ... 24. Alternatively, the timeslot may be set to zero, and the switch path set up manually using the switch control messages.

Status Response

The confirmation message (if requested) indicates success by **status** of zero.

On error, the following status value can be found in the confirmation message.

Value	Description
0xfe	The board is not licensed to run the requested software configuration
0xff	The Board Configuration Request has failed.

4.3 Hardware Control Messages

Hardware control messages are used to control various hardware devices on the board including the T1/E1 Line Interface Units (LIUs), the digital cross connect switches and the clocking mode for the board.

In a static configuration, all these hardware blocks can be set up using the s7_mgt protocol configuration utility along with the appropriate commands in the config.txt protocol configuration file.

If dynamic control of the hardware is required (or the user has elected not to use s7_mgt), the user application must build and send at least some of the hardware control messages.

The messages in the hardware control category include:

- LIU_MSG_CONFIG - LIU Configuration Request
- LIU_MSG_CONTROL - LIU Control Request
- LIU_MSG_R_CONFIG - LIU Read Configuration Request
- LIU_MSG_R_CONTROL - LIU Read Control Request
- MVD_MSG_SC_DRIVE_LIU - LIU CT bus Initialization Request
- MVD_MSG_SC_LISTEN - CT bus Listen Request
- MVD_MSG_SC_FIXDATA - Fixed Data Output Request
- MVD_MSG_RESETSWX - Reset Switch Request
- MVD_MSG_SC_CONNECT - CT bus Connect Request
- MVD_MSG_SC_MULTI_CONNECT - Multiple Connect Request
- MVD_MSG_CNFCLOCK - Configure Clock Request
- MVD_MSG_CLOCK_PRI - Configure Clock Priority Request

4.3.1 LIU_MSG_CONFIG - LIU Configuration Request

Synopsis

Message sent by the application to establish the operating mode for a Line Interface Unit (LIU).

Note: When using s7_mgt, this message is generated by s7_mgt as a result of the LIU_CONFIG command. It therefore does not need be generated by the user.

Format

MESSAGE HEADER	
Field Name	**Meaning**
type	LIU_MSG_CONFIG (0x7e34)
id	liu_id
src	Sending Module ID
dst	MVD_TASK_ID (0x10)
rsp_req	used to request a confirmation
hclass	0
status	Status Response (if confirmation requested)0
err_info	0
len	40

PARAMETER AREA		
Offset	**Size**	**Name**
0	1	liu_type
1	1	line_code
2	1	frame_format
3	1	crc_mode
4	1	build_out
5	1	faw
6	1	nfaw
7	4	Reserved for future use, must be set to zero.
11	1	ais_gen
12	1	rai_gen
13	1	Reserved for future use, must be set to zero.
14	4	clear_mask
18	22	Reserved for future use, must be set to zero

Description

This message is sent to the DSI SPCI Board to configure the operating mode a line interface unit. All configuration parameters must be supplied in the message (it is not possible to modify individual operating parameters in isolation). On receipt of the message the board first verifies that the fitted hardware options support the requested operating mode and then initializes (or re-initializes) the line interface unit.

The confirmation message (if requested) indicates success by **status** of zero.

Parameters

A description of the permitted parameter values are given below. When the DSI SPCI Board is initially configured all the line interfaces are initialized to a disabled condition.

liu_type

The physical type of interface according to the following table. The preferred method for configuring an E1 interface is to select liu_type=5.

liu_type	Description
1	Disabled (used to deactivate a LIU). In this mode the LIU does not produce an output signal.
3	E1 120ohm balanced interface.
4	T1
5	E1 120ohm balanced interface.

Note: This must be selected by the user to be appropriate for the actual hardware fitted otherwise an error status is returned.

line_code

The line coding technique taken from the following table:

line_code	Description
1	HDB3 (E1 only).
2	AMI with no Zero Code Suppression.
3	AMI with Zero Code Suppression (The appropriate bit in the clear_mask parameter may be set to disable Zero Code Suppression for individual timeslots if required.) (T1 only).
4	B8ZS (T1 only).

frame_format

The frame format taken from the following table:

frame_format	Description
1	E1 double frame (E1 only).
2	E1 CRC4 multiframe (E1 only).
4	D3/D4 (Yellow alarm = bit 2 in each channel) (T1 only).
7	ESF (Yellow alarm in data link channel) (T1 only).

crc_mode

The CRC mode taken from the following table:

crc_mode	Description
1	CRC generation disabled.
2	CRC4 enabled (frame_format must be set to 2).
3	CRC4 compatibility mode (frame_format must be set to 2).
4	CRC6 enabled (frame_format must be set to 7).

build_out

Configurable line build out is not supported by the board, so the following fixed values must be used.

build_out	Description
0	Setting for E1 devices.
1	Setting for T1 devices.

faw

The 8 bit value to be used for any E1 frame alignment word bit positions that are not modified by other options. This allows the spare bit designated "For International Use" to be set by the user when CRC4 mode is disabled. Valid values are 0x9b or 0x1b. When using T1, this parameter must be set to zero. [E1 default = 0x9b].

nfaw

The 8 bit value to be used for any E1 non-frame alignment word bit positions that are not modified by other options. Normally, this parameter is set to 0x9f for E1 operation and set to zero for T1.

ais_gen

The (initial) mode used to generate the Alarm Indication Signal (Blue Alarm) taken from the following table. The user may subsequently modify the setting of the outgoing signal using the LIU_MSG_CONTROL message.

ais_gen	Description
1	Disabled - do not generate AIS / Blue alarm.
2	Enabled - generate AIS / Blue alarm.

rai_gen

The (initial) mode used to generate the Remote Alarm Indication (Yellow Alarm) taken from the following table. The user may subsequently modify the setting of the outgoing RAI alarm using the LIU_MSG_CONTROL message.

rai_gen	Description
1	Disabled - do not generate RAI / Yellow alarm.
2	Forced active - generate RAI / Yellow alarm.
3	Automatic generation of RAI / Yellow alarm upon loss of synchronization.

clear_mask

For use with T1 interfaces and line_code mode 3 (AMI with Zero Code Suppression) to disable zero code suppression on selected channels. This parameter is a 32 bit mask. Zero code suppression may be disabled for the signaling channel timeslot by setting the appropriate bit in the mask. The least significant bit corresponds to timeslot 0 and the most significant bit to timeslot 31. Bits are set to 1 to disable zero code suppression.

Status Response

The confirmation message (if requested) indicates success by **status** of zero.

On error, the following status values can be found in the confirmation message.

Value	Mnemonic	Description
0x01	None	Invalid framer ID.
0x02	None	Invalid message length.

4.3.2 LIU_MSG_CONTROL - LIU Control Request

Synopsis

Message sent by the application to dynamically control operation for a Line Interface Unit (LIU). Allows setting of outgoing alarms and diagnostic loopbacks.

Format

MESSAGE HEADER	
Field Name	**Meaning**
type	LIU_MSG_CONTROL (0x7e35)
id	liu_id
src	Sending Module ID
dst	MVD_TASK_ID (0x10)
rsp_req	used to request a confirmation
hclass	0
status	Status Response (if confirmation requested)
err_info	0
len	16

PARAMETER AREA		
Offset	**Size**	**Name**
0	1	ais_gen
1	1	rai_gen
2	1	loop_mode
3	13	Reserved for future use, must be set to zero.

Description

This message is sent to the DSI SPCI Board to perform dynamic changes to the operation of the Line Interface Unit. It allows the user to control generation of AIS (Blue alarm) and RAI (Yellow alarm) and to activate various diagnostic loopback modes.

The confirmation message (if requested) indicates success by **status** of zero.

Parameters

ais_gen

The mode used to generate the Alarm Indication Signal (Blue Alarm) taken from the following table:

ais_gen	Description
0	Do not change AIS / Blue alarm generation mode.
1	Disabled - do not generate AIS / Blue alarm.
2	Enabled - generate AIS / Blue alarm.

rai_gen

The mode used to generate the Remote Alarm Indication (Yellow Alarm) taken from the following table:

rai_gen	Description
0	Do not change RAI / Yellow alarm generation mode.
1	Disabled - do not generate RAI / Yellow alarm.
2	Forced active - generate RAI / Yellow alarm.
3	Automatic generation of RAI / Yellow alarm upon loss of synchronization.

loop_mode

The diagnostic loop back mode taken from the following table:

loop_mode	Description
0	Do not change diagnostic loop back mode.
1	Disabled - remove any diagnostic loop.
2	Payload loopback.
3	Remote loopback.
4	Local loopback.

Status Response

The confirmation message (if requested) indicates success by **status** of zero.

On error, the following status values can be found in the confirmation message.

Value	Mnemonic	Description
0x01	None	Invalid framer ID.
0x02	None	Invalid message length.
0x03	None	Control parameters are not consistent with the type of device being controlled or with each other.

4.3.3 LIU_MSG_R_CONFIG - LIU Read Configuration Request

Synopsis

Message sent by the application to read back the current LIU configuration from the DSI SPCI Board.

Format

MESSAGE HEADER	
Field Name	**Meaning**
type	LIU_MSG_R_CONFIG (0x5e37)
id	liu_id
src	Sending Module ID
dst	MVD_TASK_ID (0x10)
rsp_req	used to request a confirmation
hclass	0
status	Status Response (if confirmation requested)
err_info	0
len	40

PARAMETER AREA		
Offset	**Size**	**Name**
0	40	Parameter area formatted as for the LIU_MSG_CONFIG message. The user should set the fields to zero and the module writes the current configuration parameters in the confirmation message.

Description

This message is sent to the DSI SPCI Board to read back the current operating configuration of the Line Interface Unit.

The user should always request a confirmation message. This indicates success by **status** of zero, and contains the current configuration parameters in the parameter area of the message.

Status Response

The confirmation message (if requested) indicates success by **status** of zero.

On error, the following status value can be found in the confirmation message.

Value	Mnemonic	Description
0x01	None	Invalid framer ID.
0x02	None	Invalid message length.
0x03	None	Control parameters are not consistent with the type of device being controlled or with each other.

4.3.4 LIU_MSG_R_CONTROL - LIU Read Control Request

Synopsis

Message sent by the application to read back the current Line Interface Unit (LIU) control options from the board.

Format

MESSAGE HEADER	
Field Name	**Meaning**
type	LIU_MSG_R_CONTROL (0x5e38)
id	liu_id
src	Sending Module ID
dst	MVD_TASK_ID (0x10)
rsp_req	used to request a confirmation
hclass	0
status	Status Response (if confirmation requested)
err_info	0
len	16

PARAMETER AREA		
Offset	**Size**	**Name**
0	16	Parameter area formatted as for the LIU_MSG_CONTROL message. The user should set the fields to zero and the module writes the current control parameters in the confirmation message.

Description

This message is sent to the DSI SPCI Board to read back the current control parameters selected for the Line Interface Unit.

The user should always request a confirmation message. This indicates success by **status** of zero and contains the current control parameters in the parameter area of the message.

Status Response

The confirmation message (if requested) indicates success by **status** of zero.

On error, the following status value can be found in the confirmation message.

Value	Mnemonic	Description
0x01	None	Invalid framer ID.
0xff	None	Invalid message length.

4.3.5 MVD_MSG_SC_DRIVE_LIU - LIU CT bus Initialization Request

Synopsis

This message is sent to the board at initialization time to set up a static switch path through the board between the Line Interface Unit (LIU) and the CT bus. It connects selected incoming voice timeslots from a T1/E1 LIU to a sequential block of channels on the CT bus and prepares the outgoing timeslots for subsequent use by the MVD_MSG_SC_LISTEN message.

Note: When using s7_mgt, this message is generated by s7_mgt as a result of the LIU_SC_DRIVE command. It therefore does not need be generated by the user.

Format

MESSAGE HEADER		
Field Name		**Meaning**
type		MVD_MSG_SC_DRIVE_LIU (0x7e18)
id		0
src		Sending Module ID
dst		MVD_TASK_ID (0x10)
rsp_req		used to request a confirmation
hclass		0
status		Status Response (if confirmation requested)
err_info		0
len		10
PARAMETER AREA		
Offset	**Size**	**Name**
0	2	liu_id
2	2	sc_channel
4	4	ts_mask
8	2	mode

Parameters

liu_id

The identifier of the T1/E1 Line Interface Unit in the range 0 to one less than the number of LIUs fitted. This parameter can also be set to the special value 0x83 to select the signaling processor instead of an LIU. In this case timeslots 0 ... 3 correspond to signaling processor 0 ... 3 respectively.

sc_channel

The channel number of the first channel to be used on the CT bus. This must be in the range from 0 up to one less than the total number of channels on the CT bus.

ts_mask

A 32 bit timeslot mask where each bit position is set to 1 if the corresponding timeslot on the T1/E1 interface is required to be connected to the CT bus. The least significant bit (bit 0) represents timeslot 0. Each timeslot for which the corresponding bit is set in **ts_mask** is connected up to the CT bus, other timeslots are not affected in any way.

Timeslots containing SS7 signaling processed by the signaling processor on the DSI SPCI Board should not be included in the timeslot mask. Usually, the mask should be set to include all bearer (voice) timeslots but no signaling timeslots. Bit 0 (corresponding to timeslot 0 on the LIU) must not be set as timeslot 0 for an E1 interface contains synchronization information whilst timeslot 0 for a T1 interface does not exist.

As an example, for an E1 interface with SS7 signaling on timeslot 16, and the remaining 30 timeslots used for voice circuits, ts_mask should be set to value 0xfffefffe. For a T1 interface with signaling on timeslot 24, ts_mask must be set to value 0x00fffffe.

mode

This parameter controls how the CT bus channels are allocated. Usually, (**mode=1**) the first timeslot connected to the CT bus is connected to **sc_channel** and each subsequent timeslot that is selected is connected to the next CT bus channel. This allows maximum utilization of channels on the CT bus.

An alternative mode (**mode=2**) (only used if there is a specific requirement for it) associates (but does not necessarily connect) timeslot 0 on the LIU with **sc_channel** and subsequent timeslots on the LIU with subsequent CT bus channels. Connections are only made when the corresponding bit in the timeslot mask is set to 1. This mode of operation preserves the spacing between timeslots that was originally found on the T1/E1 interface but does result in a number of CT bus channels being not used.

Status Response

The confirmation message (if requested) indicates success by **status** of zero.

On error, the following status value can be found in the confirmation message.

Value	Mnemonic	Description
0xff	None	Setup failed

4.3.6 MVD_MSG_SC_LISTEN - CT bus Listen Request

Synopsis

Message sent to the DSI SPCI Board to establish a connection from the CT bus to an outgoing timeslot on an T1/E1 Line Interface Unit (LIU).

Format

MESSAGE HEADER	
Field Name	**Meaning**
type	MVD_MSG_SC_LISTEN (0x7e17)
id	0
src	Sending Module ID
dst	MVD_TASK_ID (0x10)
rsp_req	Used to request a confirmation
hclass	0
status	Status Response (if confirmation requested)
err_info	0
len	6

PARAMETER AREA		
Offset	**Size**	**Name**
0	2	liu_id
2	2	timeslot
4	2	sc_channel

Description

This message is sent to the DSI SPCI Board to establish a connection from the CT bus to an outgoing timeslot on the T1/E1 Line Interface Unit (LIU). It is issued by the application and is typically used at the start of each call although it may also be issued during a call to connect to a different resource.

Correct operation of this message is dependent upon the use, at initialization time, of the MVD_MSG_SC_DRIVE_LIU message (or the LIU_SC_DRIVE command in config.txt when using s7_mgt).

When a new call arrives the application uses this message to connect the appropriate resource from the CT bus out to the network. When the call finishes, the application uses the MVD_MSG_SC_FIXDATA message to generate the appropriate IDLE pattern on the LIU.

The MVD_MSG_SC_LISTEN message can also be generated at configuration time using s7_mgt as a result of the SCBUS_LISTEN command in the config.txt file. However, this only sets up a static configuration and still requires the user application to control any dynamic connections.

Parameters

liu_id

The identifier of the T1/E1 Line Interface Unit in the range 0 to one less than the number of LIUs fitted. This parameter can also be set to the special value 0x83 to select the signaling processor instead of an LIU. In this case, timeslots 0 ... 3 correspond to signaling processor 0 ... 3 respectively.

Note: For the DSI SPCI2S, valid values for the LIU identifiers are 2 and 3.

timeslot

The timeslot number on the T1/E1 line interface unit on which the data from the CT bus is transmitted. The valid range for timeslot is 1 to 31 for an E1 interface and 1 to 24 for a T1 interface.

sc_channel

The channel number on the CT bus to which the LIU listens. This must be in the range 0 to one less than the total number of channels on the CT bus.

Status Response

The confirmation message (if requested) indicates success by **status** of zero.

On error, the following status values can be found in the confirmation message.

Value	Mnemonic	Description
0xd2	MVIP_INVALID_STREAM	Invalid stream specified in listen request.
0xd3	MVIP_INVALID_TIMESLOT	Invalid timeslot specified in listen request.
0xff	None	Invalid message length.

4.3.7 MVD_MSG_SC_FIXDATA - Fixed Data Output Request

Synopsis

Message sent to the DSI SPCI Board in order to generate a fixed pattern on a specific T1/E1 Line Interface Unit timeslot.

Format

MESSAGE HEADER	
Field Name	**Meaning**
type	MVD_MSG_SC_FIXDATA (0x7e15)
id	0
src	Sending Module ID
dst	MVD_TASK_ID (0x10)
rsp_req	Used to request a confirmation
hclass	0
status	Status Response (if confirmation requested)
err_info	0
len	6

PARAMETER AREA		
Offset	**Size**	**Name**
0	2	liu_id
2	2	timeslot
4	2	pattern

Description

This message is sent to the DSI SPCI Board in order to generate a fixed pattern on a specific timeslot of an T1/E1 Line Interface Unit. It is typically issued at initialization and whenever a call terminates to generate an IDLE pattern towards the network.

Parameters

liu_id

The identifier of the T1/E1 Line Interface Unit in the range 0 to one less than the number of LIUs fitted.

Note: For the DSI SPCI2S, valid values for the LIU identifiers are 2 and 3.

timeslot

The timeslot number on the T1/E1 line interface unit on which the fixed data is transmitted. The valid range for **timeslot** is 1 to 31 for an E1 interface and 1 to 24 for a T1 interface.

pattern

The value of the fixed data to be generated. The value must be in the range 0 to 255. Typical values are 0xff for an "all ones" idle pattern, or 0x2a for an ITU-T E1 idle pattern.

Status Response

The confirmation message (if requested) indicates success by **status** of zero.

On error, the following status values can be found in the confirmation message.

Value	Mnemonic	Description
0xd2	MVIP_INVALID_STREAM	Invalid stream specified in listen request.
0xd3	MVIP_INVALID_TIMESLOT	Invalid timeslot specified in listen request.
0xff	None	Fixed pattern generation request failed.

4.3.8 MVD_MSG_RESETSWX - Reset Switch Request

Synopsis

Resets the digital switch to its default state in accordance with the current board configuration.

Format

MESSAGE HEADER	
Field Name	**Meaning**
type	MVD_MSG_RESETSWX (0x7e00)
id	0
src	Sending Module ID
dst	MVD_TASK_ID (0x10)
rsp_req	used to request a confirmation
hclass	0
status	0
err_info	0
len	0

Description

This message is sent to the DSI SPCI Board to reset the state of the digital cross connect switch in accordance with the configuration set using the DSI SPCI Board configuration message. All CT bus streams are tri-stated leaving just switch paths established using the board configuration message (i.e., signaling timeslots) in place.

The confirmation message (if requested) indicates success by **status** of zero. On receipt of the confirmation message the operation to reset the switch has completed.

Status Response

The confirmation message (if requested) indicates success by **status** of zero. No error status values are defined.

4.3.9 MVD_MSG_SC_CONNECT - CT bus Connect Request

Synopsis

Message sent to the DSI SPCI Board to control the switch path through the CT bus switch.

Note: This message provides an alternative approach for controlling switching through the CT bus switch allowing connections to the CT bus to be utilized only as required (rather than being set up at initialization time).

Format

MESSAGE HEADER	
Field Name	**Meaning**
type	**MVD_MSG_SC_CONNECT** (0x7e1f)
id	0
src	Sending Module ID
dst	**MVD_TASK_ID** (0x10)
rsp_req	used to request a confirmation
hclass	0
status	**Status Response** (if confirmation requested)
err_info	0
len	16

PARAMETER AREA		
Offset	**Size**	**Name**
0	2	local_stream
2	2	local_slot
4	2	mode
6	2	source_stream
8	2	source_slot
10	2	dest_stream
12	2	dest_slot
14	2	pattern

Description

This message is sent to the DSI SPCI Board to control the CT bus switch. Several different actions can be performed depending on the value of the *mode* parameter, these are CT bus to local bus connection, local bus to CT bus connection, duplex connection between CT bus, and local bus and duplex connection between local bus timeslots.

The confirmation message (if requested) indicates success by **status** of zero.

Parameters

The following table depicts which parameters are required for each of the seven different modes. (* = parameter is required)

Mode	Required Parameters						
	local st	local ts	source st	source ts	dest st	dest ts	pattern
1	*	*	*	*			
2	*	*			*	*	
3	*	*	*	*	*	*	
4	*	*					
5	*	*					

6	*	*					
10	*	*					*
11	*	*	*	*			
12	*	*	*	*			

If a parameter is not required, it must be set to zero.

local_stream

The *local stream* defines which local stream to use for all the modes of operation. The local streams are either an liu_id or a special identifier to allow connection to the signaling processor as follows:

Local Stream	Connected to
0 ... 3	liu_id 0 ... 3
131 (0x83)	Signaling Processor

local_slot

The *local slot* defines which timeslot on the local stream to use for all the modes of operation. The local slot value has the following valid ranges depending on the type of local stream:

Local Stream Type	Local Slot Range
Local stream to E1 LIU	1 … 31
Local stream to T1 LIU	1 … 24
Local stream to signaling processor	0 … 3

mode

The value of the *mode* parameter determines which of the following operations to perform.

***mode* = 1** : Make a simplex connection from a timeslot on the CT bus to a timeslot on the local bus. Using parameters local_stream, local_slot, source_stream and source_slot, to specify the local and CT bus timeslots respectively.

***mode* = 2** : Make a simplex connection from a timeslot on the local bus to a timeslot on the CT bus. Using parameters local_stream, local_slot, dest_stream and dest_slot, to specify the local and CT bus timeslots respectively.

***mode* = 3** : Make a duplex connection between a local stream timeslot and 2 CT bus timeslots. Using parameters local_stream, local_slot, source_stream and source_slot, to specify one simplex connection and local_stream, local_slot, dest_stream and dest_slot, to specify the other simplex connection.

***mode* = 4** : Remove a simplex connection from a timeslot on the CT bus to a timeslot on the local bus. Using parameters local_stream and local_slot, to specify the timeslot for disconnection.

***mode* = 5** : Remove a simplex connection from a timeslot on the local bus to a timeslot on the CT bus. Using parameters local_stream and local_slot, to specify the timeslot for disconnection.

***mode* = 6** : Remove a duplex connection between 2 timeslots on the CT bus and 1 timeslot on the local bus. Using parameters local_stream and local_slot, to specify both timeslots for disconnection.

***mode* = 10** : Generate a fixed pattern (e.g., idle pattern) on a local timeslot. local_stream specifies the liu_id, local_slot the timeslot, and pattern the 8 bit data to be output on the timeslot.

***mode* = 11** : Make a simplex connection between two local bus timeslots (without using the CT bus). In this case, source_stream and source_slot specify the source of the signal in terms of liu_id and timeslot respectively. local_stream and local_slot specify the outgoing timeslot.

***mode* = 12** : Make a duplex connection between two local bus timeslots (without using the CT bus). In this case, source_stream and source_slot specify one timeslot in terms of liu_id and timeslot, whilst local_stream and local_slot specify the other timeslot.

source_stream

The *source stream* references which of the CT bus streams is used as a source of data. The parameter takes values in the range 0 … 31. For some modes (e.g., 11 and 12), this field is used to specify a local_stream instead of a CT bus stream.

source_slot

The *source slot* references the CT bus timeslot from which to connect or disconnect to the local stream. The source slot value has the following ranges depending on the CT bus speed.

CT bus speed	Source Slot Range
4 Mbps	0 ... 63
8 Mbps	0 … 128

dest_stream

The *destination stream* references which of the CT bus streams is used as a destination for the data. The parameter takes values in the range 0…31.

dest_slot

The *destination slot* references the CT bus timeslot to which a local stream timeslot can be connected or disconnected. The destination slot value has the same range as the *source slot*.

pattern

The value of the fixed data to be generated. The value must be in the range 0 to 255. Typical values are 0xff for an "all ones" idle pattern, or 0x2a for an ITU-T E1 idle pattern.

Status Response

The confirmation message (if requested) indicates success by **status** of zero.

On error, the following status values can be found in the confirmation message.

Value	Mnemonic	Description
0xd2	MVIP_INVALID_STREAM	Invalid stream specified in listen request.
0xd3	MVIP_INVALID_TIMESLOT	Invalid timeslot specified in listen request.
0xff	None	Invalid message length.

4.3.10 MVD_MSG_SC_MULTI_CONNECT - Multiple Connect Request

Synopsis

Message sent to the board to control the switch to connect multiple paths.

Format

MESSAGE HEADER	
Field Name	**Meaning**
type	MVD_MSG_SC_MULTI_CONNECT (0x7e19)
id	0
src	Sending module ID
dst	MVD_module_ID
rsp_req	May be used to request a confirmation.
hclass	0
status	0
err_info	0
len	18

PARAMETER AREA		
Offset	**Size**	**Name**
0	2	local_stream
2	4	timeslot_mask
6	2	mode
8	2	source_st
10	2	source_ts
12	6	Reserved. Must be set to 0.

Description

This message is sent to the board in order to control the configuration of the cross connect switch for more complex configurations.

Parameters

The MVD_MSG_SC_MULTI_CONNECT - Multiple Connect Request message includes the following parameters:

local_stream

The logical reference of the local stream that the message relates to, that is, 0 to one less than the number LIUs corresponding to the liu_id.

timeslot_mask

A 32-bit mask representing up to 32 timeslots on the local stream. Bit 0 corresponds to timeslot 0. A 1 in the mask indicates that the pattern should be output on this timeslot, a 0 indicates that it should be left unchanged.

mode

The mode of operation. The following table shows the permitted values and their meaning.

Value	Description
1	Make a simplex connection between an cross connect switch timeslot and a local LIU stream. Use the local_stream and timeslot_mask to specify the target destination on the CPU local bus. The source_st and source_ts.
11	Make a simplex connection between two CPU local bus stream timeslots. The source_st and source_ts parameters specify the source of the signal in terms of liu_id or CPU local bus stream reference and timeslots, respectively. The local_stream relates to the outgoing liu_id stream and cannot reference a CPU local bus stream. The timeslot_mask parameters specify the outgoing timeslots to which the source will be connected.

source_st, source_ts

When **mode** is set to 11, these parameters give the source_st and source_ts for connection to the specified local timeslots. For other modes the source_st and source_ts specify the cross connect switch stream and timeslot, respectively.

4.3.11 MVD_MSG_CNFCLOCK - Configure Clock Request

Synopsis

Message sent to a DSI SPCI Board to configure the clocking mode for the board.

Format

MESSAGE HEADER	
Field Name	**Meaning**
type	MVD_MSG_CNFCLOCK (0x7e20)
id	0
src	Sending Module ID
dst	MVD_TASK_ID
rsp_req	used to request a confirmation
hclass	0
status	Status Response (if confirmation requested)
err_info	0
len	8

PARAMETER AREA		
Offset	**Size**	**Name**
0	2	bus_speed
2	2	clk_mode
4	2	pll_clk_src
6	2	ref1_mode
8	2	Reserved. Set to zero

Description

This message is used to control the on-board clock circuitry. It allows the user to select the CT bus clocking mode and the reference clock sources for the local and bus reference clocks.

The confirmation message (if requested) indicates success by **status** of zero.

Parameters

bus_speed

This parameter is used to set the CT bus speed; the permissible values are as follows:

Value	Bus speed
0	No change
2	4.096 MHz (Reserved for future use)
3	8.192 MHz

clk_mode

This parameter determines the clocking mode for the DSI SPCI Board, the permissible values are as follows:

Value	Clock Mode
0	No change
1	CT bus Primary Master, driving Clock Set A
2	CT bus Secondary Master, driving Clock Set B
3	CT bus Slave, initially using Clock Set A
4	CT bus disabled
10	CT bus Primary Master, driving Clock Set B
11	CT bus Secondary Master, driving Clock Set A
12	CT bus Slave, initially using Clock Set B

When mode 4 is selected ("CT bus disabled"), the DSI SPCI Board is electrically isolated from the other boards using the CT bus. The CT bus connection commands may still be used, but the connections made are only visible to this board. The on-board clocks are synchronized to the configured pll_clk_src reference.

If the DSI SPCI Board is configured to be Slave to the CT bus, then it automatically switches between using Clock Set A and Clock Set B if it detects a failure on the current clock set.

When a board is acting as Primary Master, it uses the clock reference set by the pll_clk_src parameter to drive the CT bus clock.

As Secondary Master, the pll_clk_src must be set to an appropriate source ready for use if the board acting as Primary Master stops driving the CT bus clock. Until this time, the on-board clocks on the Secondary Master board are synchronized to the CT bus clock provided by the Primary Master.

pll_clk_src

This parameter determines the source of the PLL reference clock, the permissible values are:

Value	PLL Clock Source
0	No change
1	Clock recovered from one of the line interfaces according to priority order.
5	Local reference oscillator
7	NETREF 1

The PLL clock is used as the reference when acting as CT bus Primary Master.

If the clock is to be recovered from one of the line interfaces then the highest-priority in sync line interface is used as the reference. Each line interface is assigned a priority: by default liu_id=0 is the highest priority and liu_id=7 the lowest. The user may modify the priority order by sending the MVD_MSG_CLOCK_PRI message. If none of the interfaces are available for recovery, then the phase locked loop runs in holdover mode, outputting a clock with the same frequency as the last valid signal. When a valid signal returns, it waits for a short period to verify that it is stable and then automatically switches to use it as the clock reference.

If using one of the NETREF signals as the reference source, then another board in the system must be providing this reference by driving a clock source onto the appropriate CT bus NETREF lines. If the NETREF signal is lost, the board continues with the PLL in holdover mode until another MVD_MSG_CNFCLOCK message is received to switch to a new mode.

Note: If the NETREF signal recovers, it is still necessary to re-set the clock configuration and move out of holdover mode by sending MVD_MSG_CNFCLOCK and re-selecting the appropriate mode.

ref1_mode

This parameter determines whether the CT bus NETREF_1 clock is driven onto the CT bus by this board. The permissible values are as follows:

Value	NETREF_1 Clock Mode
0	No Change
1	Drive NETREF_1 using clock recovered from highest priority line interface.
6	Tri-state (i.e., Not driven)

When the NETREF_1 signal is being driven then the clock source is the highest priority line interface. If no interface is available for clock recovery, then no signal is driven onto the bus.

Driving the NETREF_1 signal is independent of the clk_mode and pll_clk_src settings for this board.

Status Response

The confirmation message (if requested) indicates success by **status** of zero.

On error, the following status value can be found in the confirmation message.

Value	Mnemonic	Description
0xff	None	Request to configure clocking mode fails.

4.3.12 MVD_MSG_CLOCK_PRI - Configure Clock Priority Request

Synopsis

Message sent to a DSI SPCI Board to configure the clock recovery priority order.

Format

MESSAGE HEADER	
Field Name	**Meaning**
type	MVD_MSG_CLOCK_PRI (0x7e21)
id	0
src	Sending Module ID
dst	MVD_TASK_ID
rsp_req	used to request a confirmation
hclass	0
status	Status Response (if confirmation requested)
err_info	0
len	8

PARAMETER AREA		
Offset	**Size**	**Name**
0	1	liu0_pri
1	1	liu1_pri
2	1	liu2_pri
3	1	liu3_pri
4	1	liu4_pri
5	1	liu5_pri
6	1	liu6_pri
7	1	liu7_pri

Description

This message allows the user to specify a priority for each line interface. When configured to recover clock from the line interfaces, this priority is used to decide which line interface to use as the clock source. The highest priority in-sync line interface is used, with the board automatically moving through the list of clock sources as line interfaces lose synchronization or are deemed stable again. If no interfaces are in sync, the board remains in "holdover" mode, based on the last valid clock that was recovered.

The confirmation message (if requested) indicates success by **status** of zero.

Parameters

liu*n*_pri

The relative priority for each LIU using the values taken from the following table:

Value	Meaning
0	No change to the interface's priority.
1 … 32	New priority value for the line interface. The value 1 indicates highest priority, 32 the lowest priority. If two interfaces are given the same priority, the lowest-numbered interface is used first.
255	Special value indicating that the line interface must not be used for clock recovery.

Status Response

The confirmation message (if requested) indicates success by **status** of zero.

On error, the following status value can be found in the confirmation message.

Value	Mnemonic	Description
0xff	None	Request to configure clock recovery priority order fails.

4.4 Event Indication Messages

Event indication messages are the mechanism by which protocol and software error events are reported to the application. These messages are generated asynchronously by different modules within the stack.

The messages in the event indication category include:

- SSD_MSG_STATE_IND - Board Status Indication
- API_MSG_CNF_IND - s7_mgt Completion Status Indication
- MVD_MSG_CLK_IND - Clock Event Indication
- MVD_MSG_LIU_STATUS - LIU Status Indication
- MGT_MSG_EVENT_IND - Error Indication
- MGT_MSG_SS7_STATE - MTP2 Level 2 State Indication
- MGT_MSG_SS7_EVENT - MTP2 Q.752 Event Indication
- MGT_MSG_MTP_EVENT - MTP3 Q.752 Event Indication

4.4.1 SSD_MSG_STATE_IND - Board Status Indication

Synopsis

Message sent to the application on completion of the reset and download sequence or on detection of a board failure.

Note: This message is not required when using the configuration utility s7_mgt.

Format

MESSAGE HEADER	
Field Name	**Meaning**
type	SSD_MSG_STATE_IND (0x06a0)
id	board_id
src	SSD_TASK_ID (0x20)
dst	mgmt_id for SSD
rsp_req	0
hclass	0
status	Board Status
err_info	0
len	0

Description

This message is used to convey the status of a board reset operation (whether success of failure) to the user.

Parameters

Board Status

Value	Mnemonic	Description
0x60	SSDSI_RESET	Processor successfully reset.
0x62	SSDSI_FAILURE	Failure to reset board.
0x64	SSDSI_BRD_RMVD	Board removed (hot swap only).
0x65	SSDSI_BRD_INS	Board inserted (hot swap only).
0x66	SSDSI_LIC_FAIL	License validation failure.
0x67	SSDSI_LIC_CRP	License corruption.
0x70	SSDSI_BCONG_CLR	Message congestion towards board cleared.
0x71	SSDSI_BCONG_ON	Message congestion towards board occurred.
0x72	SSDSI_DIS_CLR	Message congestion discard towards board cleared.
0x73	SSDSI_DIS_ON	Message congestion discard towards board.
0x74	SSDSI_FAIL	Message congestion - board failure.

4.4.2 API_MSG_CNF_IND - s7_mgt Completion Status Indication

Synopsis

Message issued by s7_mgt on completion of initial configuration sequence.

Format

MESSAGE HEADER	
Field Name	**Meaning**
type	API_MSG_CNF_IND (0x0f09)
id	0
src	0xcf
dst	Notification Module (see below)
rsp_req	0
hclass	0
status	Completion Status (see below)
err_info	Reserved for future use
len	0

Description

This message is issued by s7_mgt on completion of the initial configuration sequence and indicates either success (**status**=zero) or an error condition that occurred during configuration. The message is only issued when s7_mgt is run with the `–i` command line option specifying the module_id of the **Notification Module** to which the message is sent. For example:

```
s7_mgt –i0x2d
```

Note: It is recommended that the user invoke this option and then wait for the API_MSG_CNF_IND message to ensure the application does not attempt to send messages until initial configuration is complete.

Parameters

Completion Status

The result of initial configuration coded as follows:

Value	Meaning
0	Success
1	Error opening config.txt file
2	Syntax or value error in config.txt file
3	Error during configuration (invalid parameters)
4	Error during configuration (no response)

4.4.3 MVD_MSG_CLK_IND - Clock Event Indication

Synopsis

Message issued by the board to indicate on-board clocking related events.

Format

MESSAGE HEADER	
Field Name	**Meaning**
type	MVD_MSG_CLK_IND (0x0e23)
id	0
src	MVD_TASK_ID
dst	0xdf
rsp_req	0
hclass	0
status	Event ID (see below)
err_info	Reserved for future use
len	0

Description

This message is issued by the board to indicate events within the on-board clocking circuitry.

Parameters

Event ID

This field specifies the event that caused the indication to be generated:

event_id	Description
1	**PLL entered hold-over mode** Issued by boards acting as primary or secondary clock master when its nominated clock reference becomes unavailable. The phase-locked-loop starts operating in “hold-over” mode, continuing to generate an on-board clock at the same frequency as the last valid reference signal.
2	**PLL left hold-over mode** The nominated clock reference for a primary or secondary master board has become available and the is now being used as the input to the board’s clock circuitry.
3	**CT bus clock set A fail** The CT bus clock set A signals are not being correctly driven.
4	**CT bus clock set A recover** The CT bus clock set A signals are being driven.
5	**CT bus clock set B fail** The CT bus clock set B signals are not being correctly driven.
6	**CT bus clock set B recover** The CT bus clock set B signals are being driven.
7	**Master clock changeover** The board issuing this indication has automatically changed from secondary master to primary master role for the clock set it was configured to drive.

4.4.4 MVD_MSG_LIU_STATUS - LIU Status Indication

Synopsis

Message issued by the board to notify of changes of LIU status.

Format

MESSAGE HEADER	
Field Name	**Meaning**
type	MVD_MSG_LIU_STATUS (0x0e01)
id	liu_id
src	MVD_TASK_ID
dst	MGMT_TASK_ID
rsp_req	0
hclass	0
status	liu_status (see below)
err_info	Reserved for future use.
len	0

Description

This message is issued by the board for every change of state on the trunk interface.

Parameters

liu_id

The identity of the Line Interface Unit to which the status indication applies.

liu_status

The status field in the message header is coded as follows:

Value	Mnemonic	State
10	**LIUS_SYNC_LOSS**	Frame Sync Loss
11	**LIUS_IN_SYNC**	Frame Sync OK
12	**LIUS_AIS**	AIS Detected
13	**LIUS_AIS_CLRD**	AIS Cleared
14	**LIUS_REM_ALARM**	Remote Alarm
15	**LIUS_REM_ALM_CLRD**	Remote Alarm Cleared
20	**LIUS_PCM_LOSS**	PCM Loss
21	**LIUS_PCM_OK**	PCM Restored
22	**LIUS_FRAME_SLIP**	Frame Slip
25	**LIUS_BER5_OCRD**	BER > 1 in 100,000
26	**LIUS_BER5_CLRD**	BER5 cleared
27	**LIUS_BER3_OCRD**	BER > 1 in 1,000
28	**LIUS_BER3_CLRD**	BER3 cleared

4.4.5 MGT_MSG_EVENT_IND - Error Indication

Synopsis

Message issued to management to advise of errors or unexpected events occurring within the protocol software.

Format

MESSAGE HEADER	
Field Name	**Meaning**
type	MGT_MSG_EVENT_IND (0x0008)
id	0 (unless shown below)
src	sending module id
dst	MGMT_TASK_ID
rsp_req	0
hclass	0
status	Error Code (see below)
err_info	Timestamp
len	0

Parameters

Error Code

The Error Code is coded as shown in the following table:

Value	Mnemonic	ID	Description
0x31	S7E_RESET_ERR		MTP2 Failed to initialize.
0x33	S7E_POOL_EMPTY	l2_llid	No free buffers in MTP2 transmit pool.
0x34	S7E_TX_FAIL	l2_llid	Failed to send LSSU/FISU to driver.
0x35	S7E_HDR_ERR	l2_llid	No room to add level 2 header, SU not transmitted.
0x36	S7E_LEN_ERR	l2_llid	Length Error, SU not transmitted.
0x37	S7E_MSU_SEND	l2_llid	Failed to send SU to lower layer, protocol should handle retransmission.
0x39	S7E_BAD_PRIM	l2_llid	MTP2 unable to accept primitive.
0x3a	S7E_BAD_LLID	l2_llid	Invalid l2_llid in HDR structure.
0x3b	S7E_MEM_ERR	l2_llid	MTP2 memory allocation error.
0x3c	S7E_RTVL_ERR	l2_llid	MTP2 failure to perform retrieval.
0x51	MTP_BAD_PRIM	0	MTP3 unable to accept primitive.
0x52	MTP_POOL_EMPTY	0	No free frames in MTP3 transmit pool.
0x53	MTP_TX_FAIL	0	MTP3 failed to send MSU to lower layer.
0x54	MTP_LEN_ERR	0	MSU too long for buffer.
0x55	MTP_SLT_FAIL	link_id	Signaling link test failure.
0x57	MTP_TALLOC_ERR	0	MTP3 Failed to allocate T_FRAME.
0x58	MTP_BAD_ID	0	Invalid ID in message HDR.
0x59	MTP_MALLOC_ERR	0	MTP3 unable to allocate MSG.
0x5a	MTP_BSNT_FAIL	link_id	Failure to retrieve BSNT.
0x5b	MTP_RTV_FAIL	link_id	Retrieval failure.
0x5c	MTP_BAD_FSN	link_id	Erroneous FSN in COA.
0x5d	MTP_BAD_COO	link_id	COO received after changeover complete.
0x5e	MTP_SNMM_ERR	0	Internal software error.
0x5f	MTP_SLTM_ERR	0	Internal software error.
0x60	MTP_NO_COA	link_id	Failed to receive COA.
0x61	MTP_NO_CBA	link_id	Failed to receive CBA.
0x66	MTP_TIM_ERR	timer ref	MTP3 attempt to re-use active timer resource.
0x67	MTP_RRT_OVRFLW		Messages discarded due to overflow of Re-Routing buffer.
0x68	MTP_FLUSH_FAIL	link_id	MTP3 failed to receive Flush Ack from level 2.
0x69	MTP_FLUSH_L2	link_id	MTP2 transmission buffers flushed (due to RPO).

4.4.6 MGT_MSG_SS7_STATE - MTP2 Level 2 State Indication

Synopsis

Indication issued by the board every time the level 2 link state control state machine changes state.

Format

MESSAGE HEADER	
Field Name	**Meaning**
type	MGT_MSG_SS7_STATE (0x0201)
id	llid (Level 2 logical link id - 0 ... 3)
src	SS7_TASK_ID
dst	0xdf
rsp_req	0
hclass	0
status	Link State (see below)
err_info	Reserved for future use
len	0

Description

This message is issued by the MTP2 module every time a change of state takes place at level 2. It is intended only for diagnostic use by system management. Normally the MTP Pause and MTP Resume Indications are used by the user parts to determine destination accessibility.

The level 2 link state control state machine is defined in Q.703.

Parameters

Link State

The status field in the message header is used to indicate the state that has just been entered. It is coded as follows:

Value	Mnemonic	State
1	**S7S_IN_SERVICE**	In Service
2	**S7S_OUT_SERVICE**	Out of Service
3	**S7S_INIT_ALIGN**	Initial Alignment
4	**S7S_ALIGN_NOT_RDY**	Aligned, Not Ready
5	**S7S_ALIGN_READY**	Aligned, Ready
6	**S7S_PROC_OUTAGE**	Processor Outage

4.4.7 MGT_MSG_SS7_EVENT - MTP2 Q.752 Event Indication

Synopsis

Message issued by MTP2 to advise management of protocol events in accordance with ITU-T Q.752.

Format

MESSAGE HEADER	
Field Name	**Meaning**
type	MGT_MSG_SS7_EVENT (0x0202)
id	l2_llid
src	MTP2 module id
dst	Management module id
rsp_req	0
hclass	0
status	Event Code (see below)
err_info	Timestamp
next	0
len	0

Description

This primitive is used by MTP2 to advise management of the occurrence of protocol related events in accordance with Q.752. These events relate to the following:

- the reason for a signaling link (previously in service) going out of service (events prefixed S7F_).
- the occurrence of congestion related events (prefixed S7G_).
- a timer expired (prefixed S7T_).
- a proving failure (prefixed S7P_).

Parameters

Event Code

The Event Code is coded as shown in the following table:

Value	Mnemonic	Description
0	S7F_STOP	Stop request received
1	S7F_FIBR_BSNR	Abnormal FIBR/BSNR
2	S7F_EDA	Excessive delay of acknowledgement
3	S7F_SUERM	Excessive error rate (SUERM)
4	S7F_ECONG	Excessive congestion
5	S7F_SIO_RXD	Unexpected SIO received
6	S7F_SIN_RXD	Unexpected SIN received
7	S7F_SIE_RXD	Unexpected SIE received
8	S7F_SIOS_RXD	SIOS received
16	S7G_CONG	Onset of signaling link congestion
17	S7G_CONG_CLR	Abatement of signaling link congestion
18	S7G_CONG_DIS	Congestion event caused MSU discard
32	S7T_T1_EXP	Timer T1 expiry

Value	Mnemonic	Description
33	S7T_T2_EXP	Timer T2 expiry
34	S7T_T3_EXP	Timer T3 expiry
48	S7P_AERM	Failed proving attempt

4.4.8 MGT_MSG_MTP_EVENT - MTP3 Q.752 Event Indication

Synopsis

Message issued by MTP3 to notify management of various protocol events in accordance with ITU-T Q.752.

Format

MESSAGE HEADER	
Field Name	**Meaning**
type	MGT_MSG_MTP_EVENT (0x0301)
id	0
src	MTP3 module id
dst	Management module id
rsp_req	0
hclass	0
status	Event Code (see below)
err_info	Timestamp
len	Either 0, 1, 2 or 4

PARAMETER AREA		
Offset	**Size**	**Name**
0	len	Event specific parameters

Description

This primitive is used by MTP3 to advise management of the occurrence of protocol related events in accordance with Q.752. These events either relate to the reason for a signaling link (that was in service) going out of service (events prefixed S7F_) or the occurrence of congestion related events (prefixed S7G_).

Parameters

Event Code

The Event Code coding and the meaning of the event specific parameters are given in the following table:

- **link** is indicated as (linkset_id * 256) + link_ref, (size = 2).
- **linkset** is indicated as linkset_id, (size = 1).
- **point code** is a 4 byte value, (size = 4).

Value	Mnemonic	Paramter	Description
1	MTPEV_CO	link	Changeover
2	MTPEV_CB	link	Changeback
3	MTPEV_REST	link	Restoration commenced
4	MTPEV_RPO	link	Remote processor outage
5	MTPEV_RPO_CLR	link	Remote processor outage cleared
6	MTPEV_CONG	link	Signaling link congestion
7	MTPEV_CONG_CLR	link	Congestion cleared
8	MTPEV_CONG_DIS	link	MSU discarded due to congestion
9	MTPEV_LS_LOST	linkset	Link set failure
10	MTPEV_LS_OK	linkset	Link set recovered
13	MTPEV_DEST_LOST	point code	Destination unavailable
14	MTPEV_DEST_OK	point code	Destination available
15	MTPEV_AJSP_LOST	linkset	Adjacent SP inaccessible
16	MTPEV_AJSP_OK	linkset	Adjacent SP accessible.

4.5 Status Request Messages

Status request messages can be used to poll the status of modules or systems running on the board.

The messages in the status request category include:

- LIU_MSG_R_STATE - LIU State Request
- LIU_MSG_R_STATS - LIU Read Statistics Request
- MGT_MSG_R_BRDINFO - Read Board Info Request

4.5.1 LIU_MSG_R_STATE - LIU State Request

Synopsis

Message sent by the application to read the current state of a Line Interface Unit (LIU).

Format

MESSAGE HEADER	
Field Name	**Meaning**
type	LIU_MSG_R_STATE (0x5e39)
id	liu_id
src	Sending Module ID
dst	MVD_TASK_ID (0x10)
rsp_req	used to request a confirmation
hclass	0
status	Status Response (if confirmation requested)
err_info	0
len	1

PARAMETER AREA		
Offset	**Size**	**Name**
1	1	state

Description

This message is sent to the DSI SPCI Board to read the current operating state of a Line Interface Unit.

The user should always request a confirmation message. This indicates success by **status** of zero and contains the current state in the parameter area of the message.

Parameters

state

The current state of the LIU from the following table:

State	Description
0	OK
1	PCM Loss
2	AIS
3	Sync Loss
4	Remote Alarm

Status Response

The confirmation message (if requested) indicates success by **status** of zero.

On error, the following status values can be found in the confirmation message.

Value	Mnemonic	Description
0x01	None	Invalid framer ID.
0xff	None	Invalid message length.

4.5.2 LIU_MSG_R_STATS - LIU Read Statistics Request

Synopsis

Message used to read back performance statistics associated with a Line Interface Unit (LIU).

Format

MESSAGE HEADER	
Field Name	**Meaning**
type	LIU_MSG_R_STATS (0x5e36)
id	liu_id (in the range 0 to one less than the number of LIUs)
src	Sending module ID
dst	MVD_module_ID
rsp_req	Used to request a confirmation.
hclass	0
status	0 to read statistics 1 to read statistics and reset counters
err_info	0
len	42

PARAMETER AREA		
Offset	**Size**	**Name**
0	2	version
2	2	Reserved. Must be set to 0.
4	4	duration
8	4	bit_errors
12	4	code_violations
16	4	frame_slips
20	4	oos_transitions
24	4	errored_seconds
28	4	severely_errored_seconds
32	2	prbs_status
34	4	Reserved. Must be set to 0.
38	4	Reserved. Must be set to 0.

Description

This message is used to collect performance statistics for a given Line Interface Unit (LIU). A module requesting LIU statistic information is required to complete the version parameter of the message, request a response, and set all additional parameter values to zero.

The confirmation message shall feature a non-zero status in the event of an error. In the event of successful retrieval of information, the message parameter field shall contain LIU information as specified in the message format. The statistics can either be read and left unchanged, or read and reset in a single operation depending on the setting of the status field in the request message.

Typically, a managing application would be set up to periodically (for example, hourly or daily) read and reset the statistics and store the resulting information so that it can be accessed later for generation of performance reports for the line interface.

Parameters

The LIU_MSG_R_STATE message includes the following parameters:

version

Version of the parameter area.

duration

The duration (in seconds) since the statistics were last reset.

bit_errors

A count of the actual number of bit errors detected by the framer device for the LIU. The precise meaning of this parameter varies depending on the operating mode of the framer:

— For E1 operating modes, it is the number of errors detected in the frame alignment word.

— For T1 interfaces operating in D3/D4 frame format, it is the number of framing bit errors.

— For T1 interfaces operating in ESF format, it is the number of CRC6 errors.

Note: In general, the user should use the errored_seconds and severely_errored_seconds parameters instead since these parameters provide normalized values that have the same meaning for all modes of operation.

code_violations

A count of all the line code violations detected on the interface.

frame_slips

A count of the number of frame slips that have occurred on the interface.

oos_transitions

A count of the number of transitions from the in synchronization state to the out of synchronization state.

errored_seconds

The number of seconds since the statistics were last reset during which the interface contained errors. An *errored second* is any second during which the interface is out of synchronization, or there are frame slips or bit errors.

If the liu frame format is configured as either D4 or E1, with CRC generation disabled, then line code violations are also included in the errored second count..

severly_errored_seconds

The number of severely errored seconds since the statistics were last reset. A *severely errored second* is

a second during which the interface is out of synchronization or the bit error rate exceeds 1 in 1,000.

prbs_status

The status of Pseudo Random Bit Sequence (PRBS) indications.

- 1 = PRBS is valid, the counts are correct.

- 3 = PRBS sequence is not synchronized.

4.5.3 MGT_MSG_R_BRDINFO - Read Board Info Request

Synopsis

Message used to request basic board information.

Format

MESSAGE HEADER	
Field Name	**Meaning**
type	MGT_MSG_R_BRDINFO (0x6f0d)
id	0
src	Sending module_id
dst	MGMT_TASK_ID (0x8e)
rsp_req	used to request a confirmation
hclass	0
status	Status Response (if confirmation requested)
err_info	0
len	60

PARAMETER AREA		
Offset	**Size**	**Name**
0	1	board_type
1	1	board_rev
2	1	reserved
3	1	swa
4	1	swb
5	1	reserved
6	1	reserved
7	1	reserved
8	1	prom_maj_rev
9	1	prom_min_rev
10	8	esn
18	8	lsn
26	4	reserved
30	20	reserved
50	10	reserved

Parameters

board_type

The DSI SPCI Board type. The table shows the possible values and their meaning.

Value	Mnemonic	Meaning
2	BRDINFO_BTYPE_SPCI	SPCI2S or SPCI4 board

board_rev

The DSI SPCI Board hardware revision number.

swa

The setting of the board's rotary switch labeled "Boot".

Note: The switch should be set to 8.

swb

Geographic addressing switch setting, that is, the address at which the board appears when the -o3 feature of ssds is used.

prom_maj_rev

Firmware major revision number.

prom_min_rev

Firmware minor revision number.

esn

The board's electronic serial number.

lsn

License serial number. The serial number of the fitted license button.

Status Response

The confirmation message (if requested) indicates success by **status** of zero.

On error, the following status value can be found in the confirmation message.

Value	Mnemonic	Description
0x01	None	Invalid message length.

Protocol Configuration Using Discrete Messages

This appendix provides guidelines for protocol configuration using individual messages.

A.1 Protocol Configuration Using Individual Messages

As an alternative to using the s7_mgt protocol configuration utility (see *Dialogic® Distributed Signaling Interface Components – Software Environment Programmer's Manual*), it is possible to perform protocol configuration by building and sending messages directly to the board. This approach means that it is necessary to write some application code to handle configuration, but has the advantage that the application can, if required, reconfigure the board without restarting the application.

Communication with the board is achieved by sending and receiving messages. This process is explained in the *Dialogic® Distributed Signaling Interface Components – Software Environment Programmer's Manual* that describes the basic principles of modules and message passing. To configure the board using individual messages, the following sequence should be used. The message sequence is shown diagrammatically in Figure 2 Protocol Configuration Message Sequence Diagram.

Note: The format of the messages is described in Section 4, "Message Reference" on page 20.

1. Build and send an SSD Reset Request (SSD_MSG_RESET) to the SSD module. This message contains the parameters required to initialize the SSD module.
2. Then build and send a Board Reset Request (SSD_MSG_RST_BOARD) for each board in the system. This message contains the address (or identifier) of the board and the name of the code file. It causes the board to be reset and the code file downloaded. For each board, the application should wait until a Board Status Indication (SSD_MSG_STATE_IND) is received and inspect the status field to determine if the reset operation was successful. On failure, the user should check carefully the ssds parameters and try again.
3. Build and send a Board Configuration Request (MGT_MSG_CONFIG0) to the onboard management task (MGMT_TASK_ID) to configure the basic board parameters. When using Dialogic® DSI SPCI Boards, the value of the config_type parameter in the Board Configuration Request must be set to 2. For this version of the message, the automatic configuration of MTP parameters is not supported. Wait for the confirmation message and check the status.
4. To set up the LIU and port for the T1/E1 ports, the LIU Configuration Request (LIU_MSG_CONFIG) should be used. Wait for the confirmation message for each LIU and check the status.

For each link in the system:

5. Build and send a Layer 1 Configuration Request (MGT_MSG_L1_CONFIG) to set up the physical configuration parameters for the link. This message should be sent to the onboard management module. Wait for the confirmation message and check the status.
6. Build and send an MTP2 Link Configuration Request (SS7_MSG_CONFIG) to set up the MTP2 configuration parameters. See the MTP2 Programmer's Manual for the message definition. Wait for the confirmation message and check the status.
7. Build and send an MTP3 Module Reset Message (MTP_MSG_RESET) to reset the MTP3 module. See the MTP3 Programmer's Manual for the message definition. Wait for the confirmation message and check the status.

8. Build and send an MTP3 Module Configuration Request (MTP_MSG_CONFIG) to set up configuration parameters that relate to the MTP3 environment (number of link sets and links to support, module_ids for user part modules etc.). See the MTP3 Programmer's Manual for the message definition. Wait for the confirmation message and check the status.

For each link set in the system perform the following:

9. Build and send an MTP3 Link Set Configuration Request (MTP_MSG_CNF_LINKSET) to set up configuration parameters for the individual link set (for example, local and adjacent point codes and the number of links in the link set). See the MTP3 Programmer's Manual for the message definition. Wait for the confirmation message and check the status.

For each link in the link set perform the following:

10. Build and send an MTP3 Signaling Link Configuration Request (MTP_MSG_CNF_LINK) to set up configuration parameters for the individual link. See the MTP3 Programmer's Manual for the message definition. Wait for the confirmation message and check the status.
11. For each destination that needs to be accessed (including all adjacent signaling points), build and send an MTP Route Configuration Request (MTP_MSG_CNF_ROUTE) to set up configuration parameters for the route. See the MTP3 Programmer's Manual for the message definition. Wait for the confirmation message and check the status.
12. Proceed now with the User Part configuration procedure. Once this is complete, issue an MTP Link Activation Request (MTP_MSG_ACT_SL) for each link in the system as required to bring the link into service.

Further links, link sets and routes may be dynamically added at runtime using the same message sequences.

Figure 2 Protocol Configuration Message Sequence Diagram